The background features a large, abstract graphic composed of overlapping, semi-transparent blue polygons in various shades, ranging from light sky blue to deep navy blue. The shapes are arranged in a way that creates a sense of depth and movement, with some shapes appearing to recede into the background while others come forward. The overall effect is a modern, clean, and professional aesthetic.

TA 12.WW01 Wastewater Treatment Business Case

September 2018
Version 1.0

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1. Executive Summary

Name of business case	WW01 Wastewater Treatment		
Context	We recognise there have been issues with the operation and reporting of some wastewater treatment works and are addressing this through our Environment+ improvement programme. This programme of work is driving an environmental compliance culture whilst improving our assets and data quality. Our plans for AMP7 will build on this foundation, providing greater resilience and aspiring to deliver upper quartile industry performance on treatment works compliance.		
Customer and stakeholder views	Protecting and enhancing the environment continues to resonate strongly with our customers and stakeholders. They expect wastewater services to be delivered in an environmentally friendly way now and in the future. Accordingly, wastewater asset health and pollution incidents are high to medium priorities.		
Our aim	Our aim, through our capital maintenance and operational strategies, is to re-establish regulator confidence and return to an upper quartile position for treatment works compliance.		
Scope of this business case	All capital maintenance and base opex investment relating to Wastewater Treatment Works (WTWs).		
	Botex	Enhancement	Total
Totex (£'m)	510.8	-	510.8
Opex (£'m)	190.3	-	190.3
Capex (£'m)	320.6	-	320.6
Residual, post-AMP7 capex (£'m)	-	-	-
20-year whole life totex (£m) ¹	-	-	-
20-year cost benefit (£k)	1,959.7	-	1959.7
Materiality (% of Wastewater Networks+ price control = £2,374k)	-	-	21.5%
Relevant business plan table lines	WWS1 Line 11 WWS1 Line 13	-	WWS1 Line 11 WWS1 Line 13

¹ Our whole life costs and cost benefit figures have been calculated by extracting a 20 year portion of costs/benefits from a 60 year model. Further details are included in [TA.14.5 - PR19 Approach to Optioneering](#)

Botex		
Overview of AMP7 proposals	<p>£167m to improve resilience by mitigating 17 high priority named risks, promoted through the business-as-usual risk framework</p> <p>£67.2m to fund asset group regional sub-programmes, based on deterioration-modelled, age-based interventions</p> <p>£79m to fund Operational Direct Capex, enabling cost effective and swift resolution of emerging risks</p> <p>£7.3m to fund innovation and optimisation projects</p> <p>£190.3m to fund operating costs for 365 wastewater treatment works</p>	
Why are the proposals the best programme- level option for customers	<p>We have assessed four programme options and have selected a level of investment that delivers resilience in our asset base at a cost that is below what our customers have told us they are willing to pay.</p> <p>We have developed an AMP7 plan to meet the higher environmental standards demanded by our customers and stakeholders. We intend to deliver both a better environment and lower bills.</p>	
What we would like to highlight	<p>In AMP7 our approach is underpinned by a recommitment to doing the basics brilliantly by:</p> <ul style="list-style-type: none"> Putting the environment at the very heart of our wastewater operation through our Environment+ programme Fully utilising our comprehensive effluent monitoring and response capabilities, with greater use of data analytics Developing and deploying efficient Tier 2 capital delivery mechanisms for routine maintenance and like-for-like replacements Using advanced asset management tools and processes to target investment that is based on root-cause analysis, and promoted against customer priorities Promoting maintenance activities based on criticality and driving performance through our Operational Excellence programme 	
Performance Commitments supported by this business case		
PC	How relevant is this business case?	Comment
Treatment works compliance	High	309 of a total of 328 effluent discharges that contribute towards this commitment are within the Wastewater Treatment asset base. We will aim for 100% compliance against the measure and commit to achieve and maintain 99.09% compliance by 2023
Pollutions	Low	Pollutions from WTWs contribute ~10% of total pollutions events from wastewater assets. We will reduce pollutions from WTWs to <9 per year and contribute to overall upper quartile industry performance against the measure by 2024

2. Scope of Technical Annex

Our wholesale business plan for PR19 has been valued at £3.9 billion. This technical annex describes £510.8 million of base investment in Wastewater Treatment capital maintenance, within the Wastewater Networks+ price control, as shown in Figure 1 below.

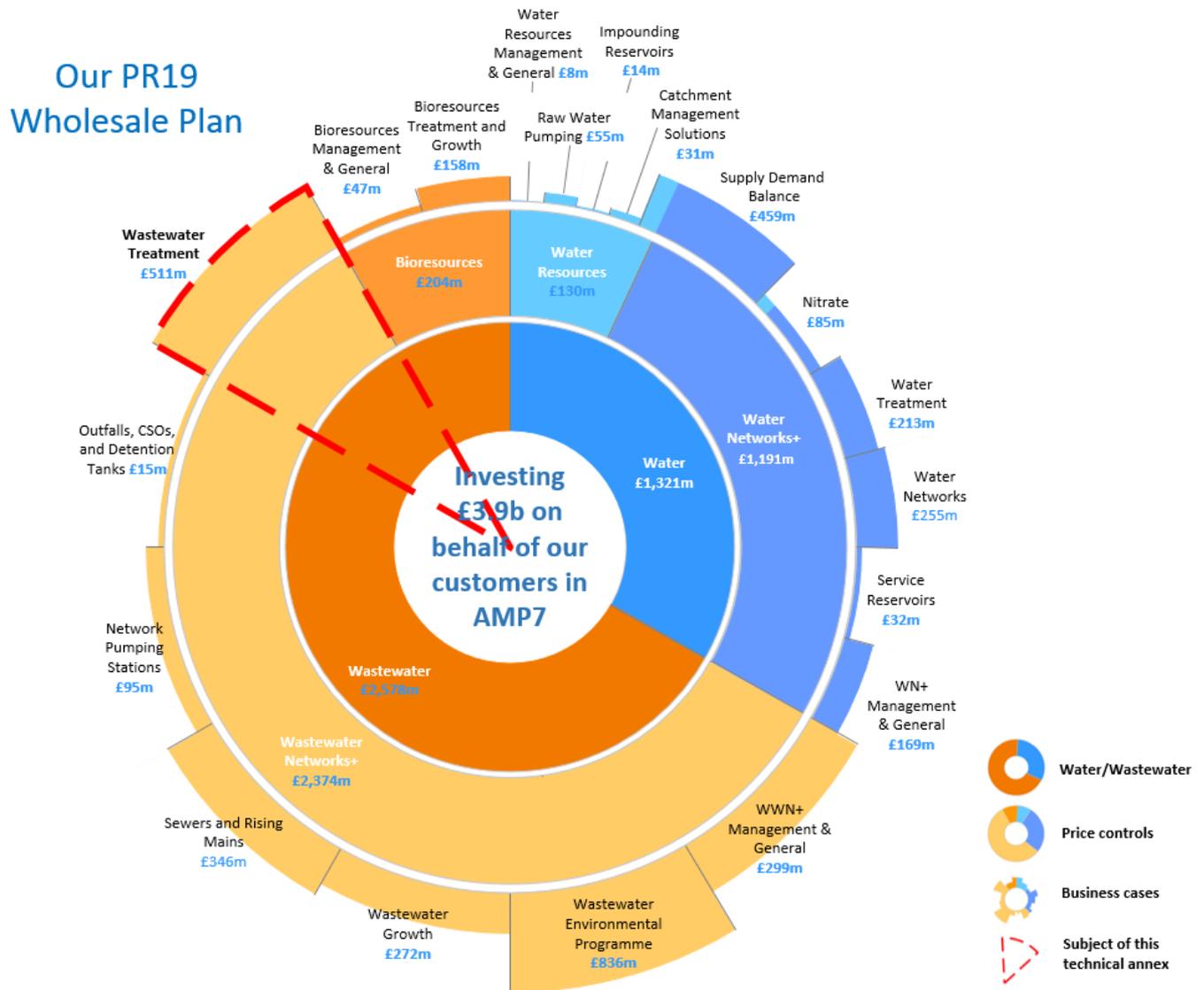


Figure 1: Our PR19 Wholesale Plan

3. AMP6 Strategy

3.1. Investment Strategy

Our historic wastewater treatment strategies have centred around:

- Innovative online effluent monitoring that has significantly improved our resilience and response capabilities to emerging final effluent compliance risks. Our systems constantly monitor effluent compliance on all sites with numeric permits, highlighting deteriorating performance sooner.
- Strengthening resilience with a new mobile plant fleet, deployable to high-risk sites, enabled by our improved assessment/rapid deployment capabilities. This innovative approach greatly enhances the efficiency, resilience, and cost of our wastewater operation, with interventions to emerging and seasonal risks delivered at lower cost than comparable permanent installations.
- Improving asset management and prioritising investment through an in-house Planning and Resilience team. We now scrutinise all proposed investment through the Asset Lifecycle Process (ALP), targeting funding at the most significant risks (see section 5.1).
- Swift resolution of emerging risks through the allocation and full utilisation of Operational Direct Capex, used for simple like-for-like replacements.
- Enhancing our in-house engineering and design capability.
- Building our customers' priorities into the investment needs assessment process through the Asset Risk Management (ARM) tool. This is a key part of our wastewater risk framework.
- Maximising risk reduction through the greater use of deterioration modelling to form regional investment programmes for critical asset types.
- Protecting customers through the adoption of an incentivised performance commitment that measures failed works on a per capita basis. By shifting the focus of capital investment towards larger works we have reduced the risk of non-compliant high-volume discharges and minimised impacts on receiving watercourses.
- Focussing on innovation, continuous improvement, and behavioural interventions through an Asset Optimisation team. We have sped up the delivery of short-term payback projects and will yield sustainable operational benefits of £4 million per year by 2020. We are also promoting affordability by identifying and promoting efficiency opportunities within the wastewater business.
- Investing in our people through in-house operator skills training.

Table 1 shows wastewater treatment actual and forecast spend in AMP6 as at year 3.

Table 1: Wastewater treatment spend in AMP6

	AMP6 Actual (£m)					
	2015/16	2016/17	2017/18	2018/19	2019/20	AMP6 Total
TOTEX	123.116	108.489	118.465	123.249	86.896	560.216
CAPEX	57.306	55.760	65.721	70.867	34.298	283.952
Waste Water Treatment works - Regional programmes	18.461	17.088	18.909	19.141	18.882	92.482
Waste Water Treatment works - Named schemes	21.515	21.457	26.774	29.471	9.039	108.257
WTW Operational Direct Capex	17.330	17.215	20.038	22.254	6.376	83.213
OPEX	65.810	52.729	52.744	52.383	52.598	276.264
Wastewater Treatment Operating costs	65.810	52.729	52.744	52.383	52.598	276.264

3.2. Customer Benefits & Resilience

Our customers expect us to protect and enhance the natural environment. In wastewater treatment we measure ourselves against their expectations by reporting our performance against four commitments that we made to customers at the beginning of AMP6. The AMP6 performance commitments relevant to this technical annex are:

- WTW numeric compliance
- WTW population equivalent compliance
- Category 3 pollution incidents
- Odour complaints (at two named WTWs)

In AMP5/6 our performance against Category 3 pollution incidents, and Odour complaints improved. We also ran a successful sludge thickening programme which helped to protect customers from the nuisance of excessive heavy vehicle movements by reducing the volume of liquid sludge removed from our WTWs by road.

Conversely, we failed to meet our specific commitment to reducing odour complaints from Portswood, one of the named WTWs for odour complaints, to zero by March 2018 and although we are already performing well in some areas, we recognise that our historical performance has not been good enough.

Wastewater Treatment Works compliance

There are two AMP6 performance commitments that relate to WTW compliance: WTW numeric compliance, and WTW population equivalent compliance.

The numeric compliance performance commitment requires compliance with permitted numeric conditions at WTWs as defined by the Environment Agency's (EA) Environmental Performance Assessment (EPA) methodology. Compliance is measured by routine sampling in accordance with the Urban Waste Water Treatment Regulations (1994) and the Water Resources Act (1991).

In 2016 there were 293 permitted discharges on WTWs, as defined by the EPA. Due to changes in the EA's EPA methodology, this number increased to 309 permitted WTW discharges in 2017, and again to 328 covering both wastewater treatment works (WTWs) and water supply works (WSWs). These figures are used to calculate percent compliance.

For numeric compliance, our reported performance for 2017/18 was 98.17%², equating to 6 failed works (WTW and WSW). We are forecasting 98.48% for the remaining years of AMP6, which is equal to 5 failing works per year.

We provide a significant amount of data to the EA and Ofwat about the performance of our assets and any wastewater or sewerage discharges we make into the water environment such as rivers, streams and coastal waters. We are committed to transparent reporting of high quality data that can be trusted by our customers, stakeholders and regulators.

In our 2016/17 Annual Report we identified the need to review and improve our end-to-end reporting processes with a view to implementing process and control improvements. Our review has identified that we have fallen short of these high standards and we have identified shortcomings in the application of our business processes. We take these shortcomings seriously and have prioritised improvements in controls with regard to our self-monitoring of Wastewater Treatment Works performance. These improvements are already being implemented via additional internal controls and internal assurance and an improved culture with focus on trust and transparency.

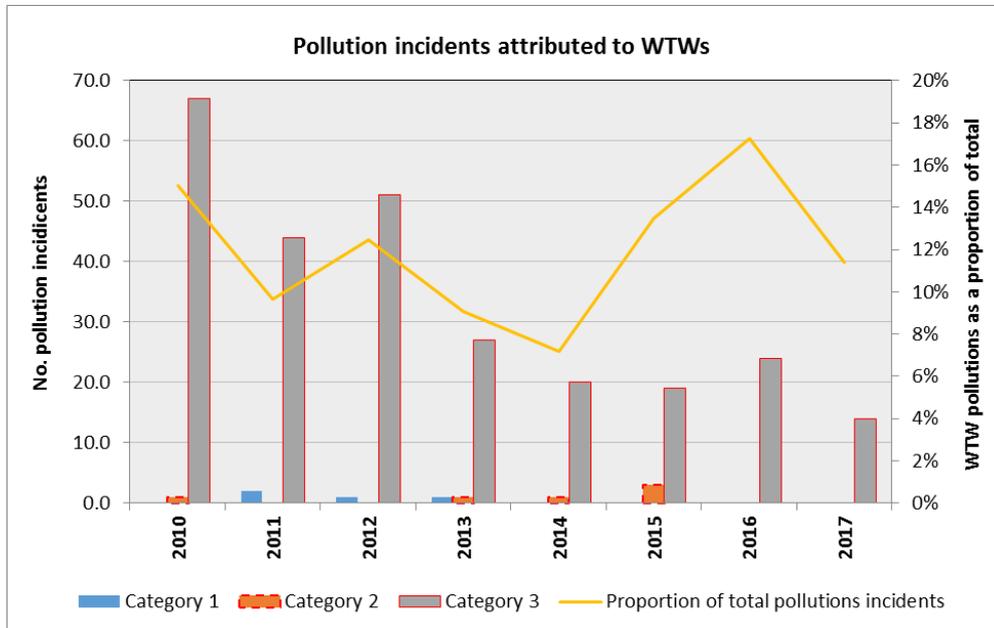
We have significantly improved the level of internal assurance which has enabled the independent external assurance review of 2017/18 data. We have also carried out this improved assurance on 2016/17 data which has identified a need to correct previously reported performance for WTW numeric compliance, and WTW population equivalent compliance.

The additional technical assurance that we have carried out on wastewater treatment performance data for 2016/17 and 2017/18 is currently being applied to previous years. We are continuing our review of performance and will update on any further findings in due course.

² The 98.17% performance figure represents WTW and WSW discharge compliance against the EPA and can be found in the accompanying Data Table WWS18. The corresponding 2017/18 performance figure given in Data Table App1 is 98.38%. AMP6 performance in App1 includes WTW compliance only.

Category 3 Pollution incidents

After network infrastructure, WTWs have the biggest potential to impact the overall number of pollution incidents.



[Redacted text]

[Redacted text] Our customers continue to want us to prioritise minimising pollution incidents causing an adverse impact on the environment. Our strategy for meeting those expectations, measured by our aim for upper quartile industry performance against the customer measure, is described in the separate technical annex [TA.12.WW07 Flooding and Pollution Strategies](#).

Odour nuisance

In AMP6 we set a target to limit the number of customer contacts as a result of unpleasant smells from WTWs to 403 per annum for the AMP6 period which represents a 5% improvement on AMP5 performance. We set a separate internal target of 360 contacts per annum.

Figure 3 shows how total odour complaints from our Wastewater Treatment Works and Wastewater Pumping Stations (WPSs) have reduced over time.

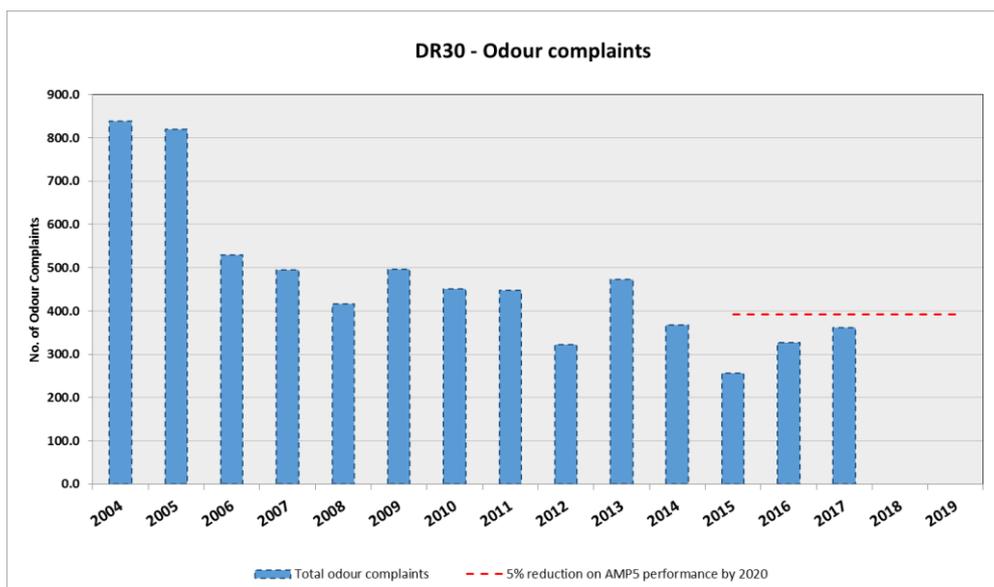


Figure 3: Odour complaints from Wastewater Treatment Works and Wastewater Pumping Stations

Overall we are on track to achieve the odour performance target of fewer than 403 complaints per year in AMP6.

Within our AMP6 business plan we also made a specific commitment to reduce odour complaints arising from two named WTWs (Portswold WTW and Tonbridge WTW) to zero by March 2018 and made investment plans to meet this objective.

35 odour complaints have been received in respect of Portswold WTW so far this year and this figure is forecast to increase to 40 by the end of the year. The capital scheme to resolve odour issues at Portswold is due to complete in August 2018 and once delivered we anticipate that we will be able to achieve our performance commitment during the remainder of AMP6 and beyond.

Tonbridge WTW has received no odour complaints in AMP6 to date.

4. Drivers for Change

Although we can evidence positive performance against AMP6 customer measures, we have not always succeeded in securing a level of compliance in our wastewater operation that our customers, regulators, and stakeholders have a right to expect. In recognition of this we are assisting the Environment Agency and Ofwat with ongoing investigations in relation to the operation of some of our WTWs and our compliance reporting processes.

For the remainder of AMP6 we are completely focussed on improving our internal controls and processes and are developing a modern compliance framework. We are adopting a 'three lines of defence' framework for our assurance activities, applying multiple levels of control, and we have established a new Compliance and Asset Resilience team to place compliance at the heart of the business.

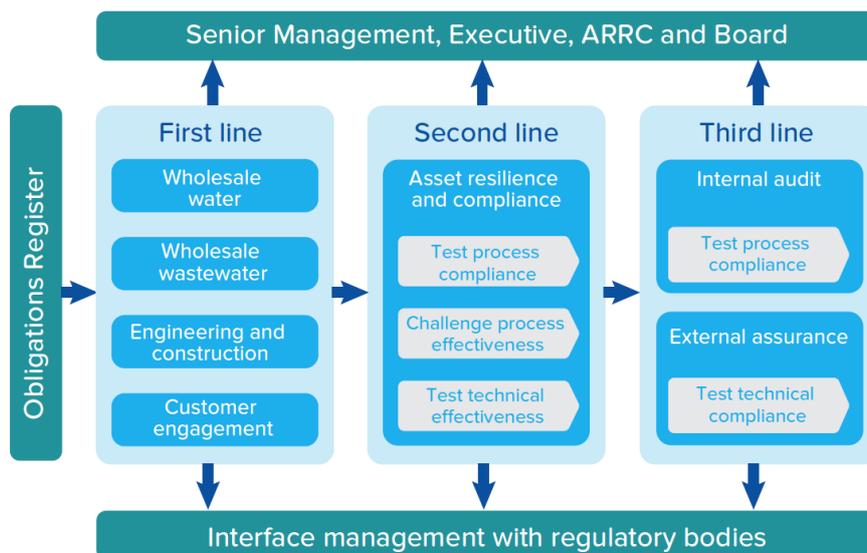


Figure 4: 'Three lines of defence' framework

More detail on our ambitious transformation programme can be found in [Chapter 7](#).

4.1. Customer and Stakeholder Views

As outlined in [Chapter 4](#), we used insight from our extensive programme of customer and stakeholder engagement to develop a deep understanding of the views and priorities of our customers. All insight gathered from our customer and stakeholder engagement programme can be found in the technical annex to [Chapter 4 - engagement deliverables \(TA.4.4\)](#).

Our customers believe we have a duty to protect and enhance the environment. Doing no harm to the environment has been outlined as a minimum requirement for customers, whilst protecting and enhancing the natural environment is the level of service that they expect. Customers want water and wastewater services to be delivered in an environmentally friendly way now and in the future.

Maintaining the health of our water and wastewater assets is a high priority for customers. They expect us to ensure we can deliver the same level of service in an environmentally friendly manner for future generations. Avoiding pollution incidents is a medium priority for customers. Similarly, our stakeholders expect us to improve how we measure our environmental impact and to heavily reduce our impact on the environment.

Through the customer and stakeholder engagement process we extensively gathered insight from customers of the future. The focus of this group is on protecting and enhancing the environment in the short and long term. They make a strong connection between treatment works compliance and the environment, and as such, generally rank this measure higher than other customer groups.

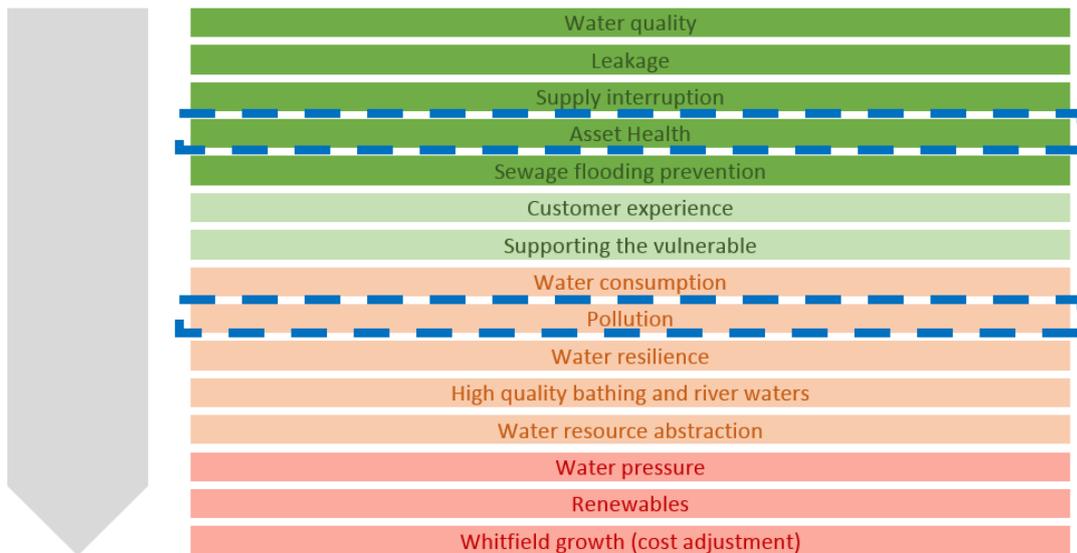


Figure 5: Relative priority of services according to our customers

We have used this understanding of our customers’ priorities to define a set of performance commitments and investment proposals and validated and refined these over the course of our programme of customer engagement. Our success at delivering on these priorities for our customers will be measured by our performance against the AMP7 performance commitments outlined in section 5.4 below.

4.2. Future Trends & Pressures

We must improve our wastewater treatment compliance, so it is vital to understand and plan for a number of emerging trends and pressures.

Increased underlying risk in asset base

Many of our existing wastewater assets are deteriorating with age. Historic investment in additional processes to meet tightening environmental permits and population growth has resulted in a larger and more diverse asset base, which must be refurbished and replaced as it ages. Such a diverse asset base also places demands on our people to ensure continued performance.

For the first half of AMP6, there has been a greater focus on operational interventions and effective use of temporary plant to manage short term or seasonal risks. Whilst this totex based approach is an efficient way to manage emerging compliance risks, it does not remove the need for robust planned capital works.

Accordingly, we can see a return to a pre-AMP6 level of risk in the asset base, shown in Figure 6 below.

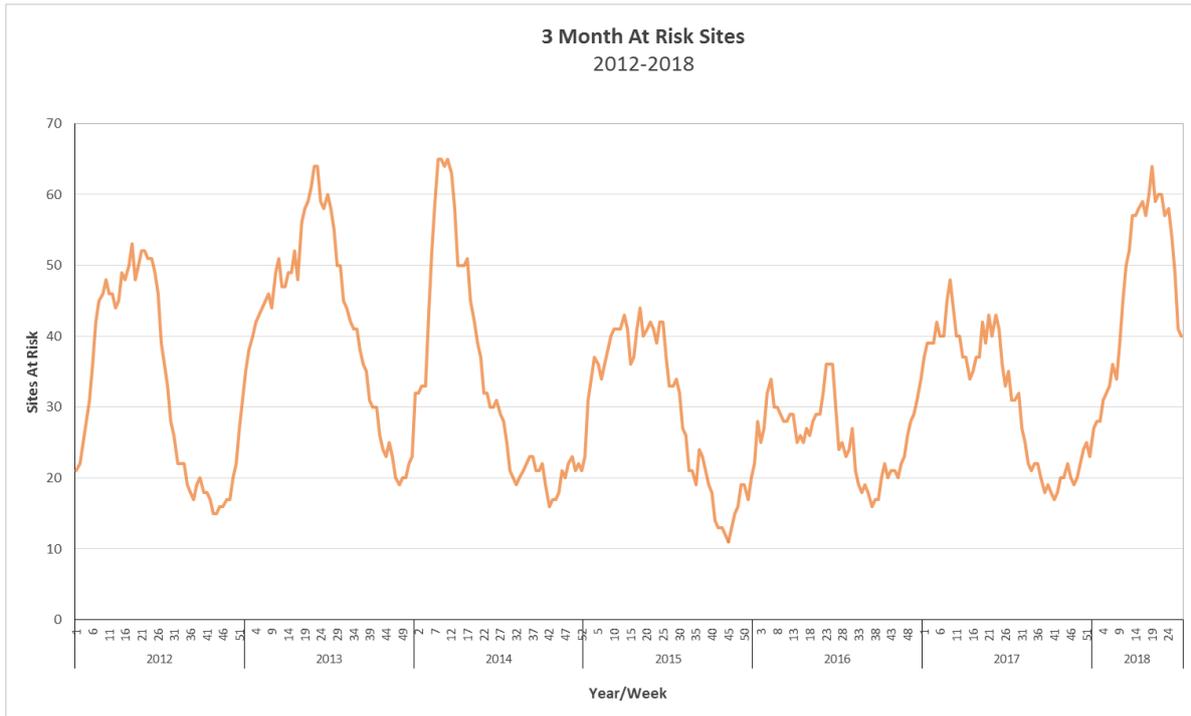


Figure 6: Rolling three month risk profile

We have effectively managed effluent compliance risks in AMP6 through action plans, temporary plant, and increased maintenance and inspection. Greater planned capital expenditure will be necessary in AMP7 to improve the resilience of the asset base.

The Water Industry National Environment Programme (WINEP)

The increasing scale, pace, and breadth of the Water Industry National Environment Programme (WINEP) will greatly enhance standards of environmental protection and improvement. It also challenges water companies to innovate more to improve their performance, meeting new requirements through extensive investment while reducing customers' bills.

The increased size of the AMP7 quality programme has resulted in a large recharge to capital maintenance through the QBEG allocation mechanism. Our objective is to adequately allow for our obligations under the WINEP whilst also meeting our high-risk capital maintenance requirements without putting pressure on our customers' bills. This remains a significant challenge.

For a more detailed discussion of the strategy for investment in Quality in AMP7, please refer to [TA.12.WW06 Wastewater Environmental Programme](#).

Growth

The South East remains one of the UK's most dynamic regions for growth. Our projections of population growth forecast a 15% increase by 2040.

Urban expansion often results in properties being built closer to WTW boundaries, increasing the requirement for good performance and effective odour management systems. The resulting proximity of wastewater treatment assets to customer homes has increased our proportion of complex and expensive covered or buried treatment processes. Additional treatment capacity provided through new and enhanced treatment works is also needed. Meeting current and past growth means our existing sites have less redundancy, requiring investment in greater resilience. See [TA.12.WW05 Wastewater Growth](#) for more on this.



Regional environmental factors

With 700 miles of coastline, including 83 designated bathing water beaches³, a significant number of our WTWs have coastal discharges. This creates issues around septicity through saline infiltration, and hydrogen sulphide generation and can cause complications for the planned and reactive maintenance of concrete structures. In such situations, we accept that complex solutions to persistent problems may incur additional associated costs and have incorporated this into our investment proposals.

Wastewater treatment works are constantly being subjected to an increasing number of new pollutants. We were the first UK WaSC to publish a formal plastics policy in 2018 and we intend to meet the challenge this presents in a comprehensive and effective way.

5. AMP7 Strategy

5.1. Investment Strategy

Our AMP7 strategy builds on the successful foundations established in AMP6 whilst delivering a number of key improvements. Fundamentally, base wastewater treatment investment will continue to focus on mitigating the highest risks and protecting the most critical sites/asset classes. Building on our existing work to prioritise investment and operate, maintain, optimise, and replace assets efficiently, our capital maintenance programme will centre around our commitment to be brilliant at the basics.

The AMP7 investment proposal is shown in Table 2 below.

Table 2: Breakdown of Wastewater Treatment AMP7 total expenditure by programme

	AMP7			
	Price Control	QBEG	Ofwat Table	AMP7 Total (£m)
TOTEX				510.813
CAPEX				320.560
Waste Water Treatment works - Regional programmes	Wastewater networks +	Base main –Non Infra	WWS1 Line 13	67.222
Waste Water Treatment works - Named schemes	Wastewater networks +	Base main –Non Infra	WWS1 Line 13	166.976
Asset Performance Intervention	Wastewater networks +	Base main –Non Infra	WWS1 Line 13	7.323
WTW Operational Direct Capex	Wastewater networks +	Base main –Non Infra	WWS1 Line 13	79.039
OPEX				190.253
Waste Water Treatment works - schemes opex	Wastewater networks +	Base main –Non Infra	WWS1 Line 11	0.808
Wastewater Treatment Operating costs	Wastewater networks +	Base main –Non Infra	WWS1 Line 11	201.545
AMP6 Enhancement Opex Adjustment	Wastewater networks +	Base main –Non Infra	WWS1 Line 11	-12.100

A full description of each programme line immediately follows.

³ <http://environment.data.gov.uk/bwq/profiles/data.html> - 14.06.2018

Wastewater Treatment works – Regional programmes are based on deterioration-modelled age-based asset interventions and make up £67.2 million of the planned total expenditure. Regional programmes are defined at an equipment set level and cover age-based replacement and maintenance for the following asset groups: Screens and Handling Equipment, Biofilters, Activated Sludge Plants, Control Systems, Generators, Pumps, Odour Control Systems, Tertiary Treatment, Tanks, and Meters. In business-as-usual delivery, deterioration modelled outputs are compared with emerging and defined risks prioritised through our Asset Risk Management (ARM) tool and are subject to robust challenge via our Planning and Resilience team.

Wastewater treatment works - Named schemes refers to 17 specific interventions that have been selected to target the main wastewater treatment capital maintenance risks and represent £167 million of planned expenditure. The process followed to develop notional solutions to address named risks is described below in section 5.1. A complete list of schemes is presented in Appendix 1 below.

East Worthing – a named capital maintenance scheme

Case study



Customers and the wider community in Worthing have experienced flooding and pollution, this is not the service we aim to provide on their behalf. We have undertaken a comprehensive root cause investigation, using asset data to understand the reasons for failure. Liaising with the Environment Agency we have developed a structured plan of improvements at the site, including planned improvements to the redundancy and reliability of preliminary and primary treatment stages. This structured planning and engineering approach has enabled us to improve the cost efficiency of the solutions, [REDACTED]. [REDACTED] This phased programme has continued to build operational resilience, focussing on the highest risk areas first.

Asset Performance Intervention. This programme aims to maximise capital investment opportunities that have efficiencies in operational expenditure as their principal driver. The programme is representative of our commitment to promote innovation, as well as a long-term commitment to affordability and efficiency.

Operational Direct Capex comprises small scale capital refurbishment and servicing costs. We have set AMP7 funding based on our AMP6 expenditure, recognising the resilience and efficiency benefits enabled by the fast response capabilities accessed through this investment programme. Operational Direct Capex makes up £79 million of the planned expenditure.

AMP7 **opex** expenditure is based on AMP6 expenditure and takes into account efficiency strategies coming into effect in years 4 and 5 of AMP6. AMP7 opex is subject to a further year-on-year efficiency factor. The £190.3 million opex presented in Table 2 treats opex arising from AMP6 enhancement spend as enhancement expenditure in line with the accompanying Data Tables WWS1 and WWS2. In our AMP7 Wholesale Delivery plan the same opex is treated as base expenditure. This creates the need for a £12.1 million adjustment which is presented in Table 2 above and fully aligns to our AMP7 Wholesale Delivery Plan. The corresponding adjustment can be found in the separate technical annex [TA.12.WW06 Wastewater Environmental Programme](#).

Opex stated includes a small element arising from planned capital works in AMP7 (referred to as *Wastewater Treatment works – schemes opex* in Table 2 above).

Figure 7 below presents each planned AMP7 wastewater treatment investment category as a proportion of the total investment described in this technical annex.

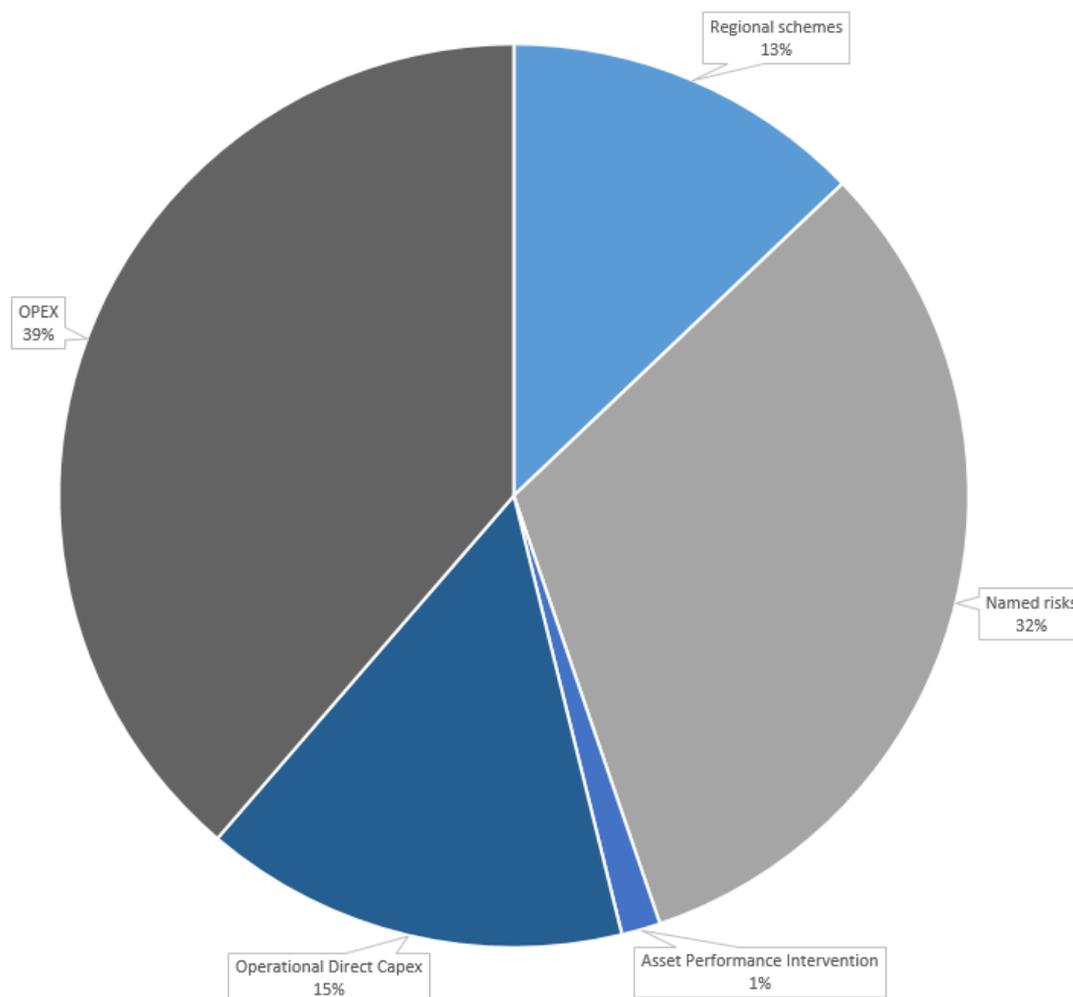


Figure 7: Wastewater Treatment planned AMP7 investment by programme

Based on the level of expenditure proposed in AMP7, Table 3 presents the investment required in WTW capital maintenance to AMP9 to maintain a level of resilience, as suggested by the deterioration model.

Table 3: Future investment in WTW capital maintenance based on proposed AMP7 spend

(£m)	AMP6	AMP7	AMP8	AMP9
TOTEX	560.216	510.813	575	585
CAPEX	283.952	320.560	350	360
OPEX	276.264	190.253	225	225

The specific strategies that will be deployed within the wastewater treatment asset base to provide resilience and deliver against our customer and stakeholder performance objectives are described immediately below. The strategies discussed should be considered in the context of our broader strategic objectives, which include 5 cross cutting transformational programmes: **Catchment First**, **Network 2030**, **Target 100**, **Sustainable Drainage 2030**, and **Resource Hubs**.

A full discussion of these topics can be found in [Chapter 3 - Our Ambition](#).

Environment+

Our Environment+ programme of work is about taking ownership of past compliance performance and transforming the way we respect, protect, and enhance the environment by improving our resilience and compliance capabilities. It ensures that the environment is at the centre of our day-to-day activities by embedding effective and transparent working practices alongside sustainable improvements to our policies, processes, and reporting.

In AMP7 we will:

- Identify and address issues presenting a high risk to permit compliance at all of our WTWs
- Deliver continual improvements to the accuracy and timeliness of our spill reporting system and develop advanced spill monitoring capabilities
- Develop new maintenance strategies focussed on criticality and take account of the wider river catchment

Through these measures we aim to regain regulator and stakeholder confidence in our compliance reporting activities and return to an upper quartile industry position on treatment works numeric compliance.

Please see [Chapter 7 - Delivering Beyond Resilience in the Round](#) for further information on the Environment+ programme.

Better planning using the Asset Lifecycle Process

The asset management tools we developed in AMP5 and AMP6 enable us to identify and prioritise risk more effectively. With enhanced planning and resilience capabilities we have adopted a longer term investment planning model, increasing our bulk purchasing options. Planning further ahead also gives us greater scope to reduce programme costs, particularly when deciding to buy or rent plant and equipment.

We will fully deploy our newly developed Failure Modes, Effects, and Criticality Analysis (FMECA) process, to ensure we have a consistent approach to scoring risks promoted through our asset management systems. We can now identify and address the highest business risks through the planned capital investment route much sooner and with far greater confidence. We can therefore target investment effectively, with structured bottom-up assessments of investment needs. FMECA also enables the optimisation of existing assets. The progression of the asset management strategy through AMP5, AMP6, and AMP7 is shown in Figure 8.



Figure 8: The evolution of asset management strategy over AMP5-7

In AMP6 we introduced the Asset Lifecycle Process (ALP) to improve investment targeting and ease-of-access to streamlined business processes for the realisation of construction and maintenance activities from a totex perspective. Developed with a greater understanding of whole-life asset costs, our proposed AMP7 solutions are more resilient. Figure 9 below illustrates the use of the Asset Lifecycle Process in a typical scheme development timeline.

The Asset Lifecycle Process is discussed in more detail in [TA.14.5 - PR19 Approach to Optioneering](#).

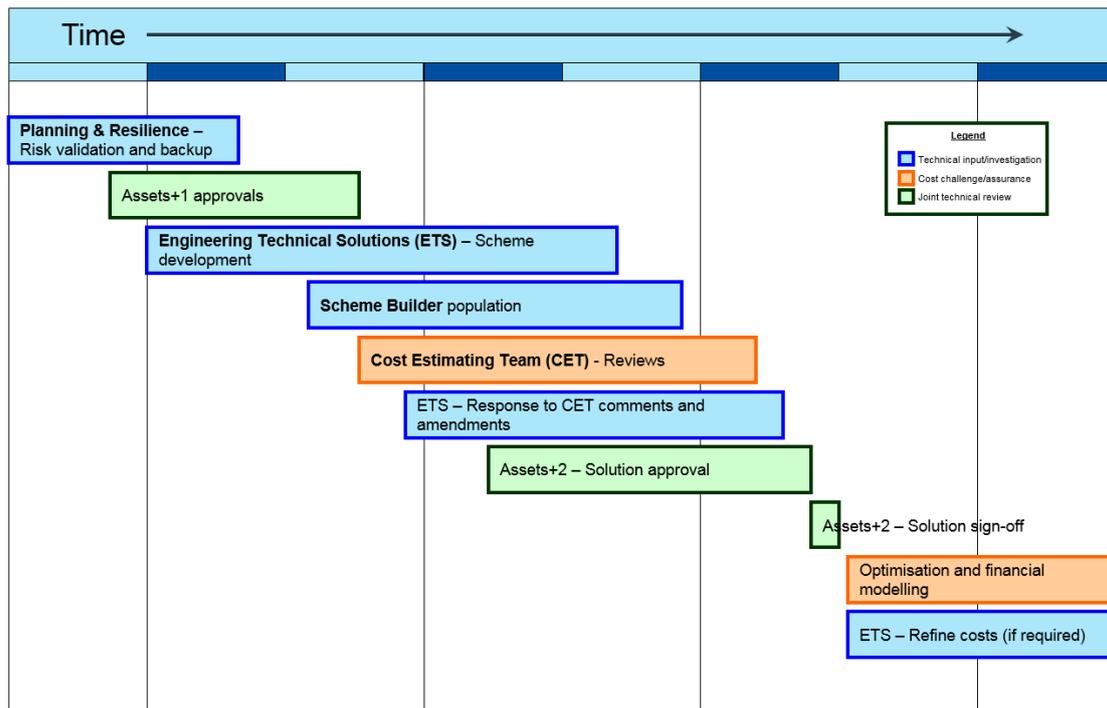


Figure 9: Overview of typical scheme development using the Asset Lifecycle Process (ALP)

Our business processes concerning asset management are published in our Business Management System (BMS), which operates according to the quality management principles set out in ISO9001 and is seeking formal accreditation by 2019.

Market mechanisms: Use of Tier 2

In AMP6 there was a perceived over-reliance on Tier 1 delivery mechanisms for WTW capital maintenance work. Many of these contracts led to extended design periods, leading to delays in the first half of AMP6.

In AMP7 more like-for-like replacement and routine maintenance projects will be actioned by project management teams and contractors with expertise in small scale delivery.

We will achieve greater efficiencies in routine like-for-like replacement work through Tier 2 contractors through utilising local knowledge and expertise and encouraging a more realistic balance between the risks borne by ourselves and within the supply chain. This will free up in-house strategic delivery partner design resource, allowing greater scrutiny of complex schemes where innovation is incentivised.

The majority of wastewater capital maintenance activities in AMP7, including all investment opportunities with an estimated outturn of <£5 million, will use established and effective Tier 2 contract mechanisms. To ensure compliance with spend profiles, proposed programmes of work have already been widely shared with the relevant delivery teams for detailed planning and feasibility to begin. This will ensure that work can begin on constructing the capital maintenance programme on day 1 of AMP7.

A minority of schemes, including all investment opportunities with a likely outturn of >£5 million requiring specialist technical design and engineering support, will use Tier 1 delivery mechanisms. These schemes will require AMP6 studies and design work to enable an early AMP7 start which will aid smoothing out the typical year 3 investment cycle peak.

Operational response capability

In AMP7 we will build upon the final effluent monitoring capabilities that we developed and effectively utilised in AMP5 and AMP6. By making greater use of predictive analytics we will be able to better respond operationally to emerging risks.

We will make greater use of the 'quick-fix' Operational Direct Capex reserve to resolve simple high-priority risks, enabling faster operational interventions to address minor faults and plant out of action. A resilient temporary plant inventory will enable us to swiftly mobilise temporary and modular plant to ensure ongoing resilience. Will we support this with more in-house mechanical & electrical workshops and the upskilling of our maintenance teams.

5.2. Plan Options

To ensure the proposed wastewater treatment plan delivers the required levels of performance at a totex whole life cost that protects customers we have iteratively developed numerous options. These can be grouped into programme level options, and scheme level options. Both categories are discussed below.

Programme options

At a programme level we have considered four principal options for investment in WTW capital maintenance in AMP7 and have modelled the medium to long term impacts of each to ensure adequate levels of resilience, performance and affordability beyond AMP7.

The options include unconstrained investment to maintain stable service with regards to WTW numeric permit compliance and pollution incidents. We have also considered several options at a lower level of expenditure although these are likely to result in a deterioration in service to our customers.

Our preferred option is to invest £510.8 million (£320.6 million capex, £190.3 million opex) in AMP7 which is affordable for our customers. This option suggests that we will experience a marginal increase in the risk of WTW permit non-conformities, however our AMP7 strategies will create a more resilient wastewater operation and the increased risk will be managed and mitigated through the activities described in section 5.1 above.

Using deterioration modelling, the following scenarios have been assessed⁴:

- Option 1: The optimum deterioration model solution representing unconstrained investment to maintain stable service with regard to WTW numeric permit compliance and pollution incidents. Includes all non-cost-beneficial items outside of the optimum solution that have been forced as mandatory interventions and set to achieve stable service
- Option 2: The lowest cost in AMP7 to maintain a stable level of performance against customer priorities. Investment required to maintain steady serviceability not delivered in AMP7 has been phased into AMP8 and beyond
- Option 3: As option 2, with a further £30 million reduction in AMP7 funding for the mitigation of known high capital maintenance risks
- Option 4: As option 2 with the impact of allowing serviceability to drift out to AMP10 considered

The overall impact of varying levels of AMP7 investment are assessed below in terms of their affordability and the level of resilience they offer.

⁴ Analysis generated using the deterioration model is considered to provide an indicative level of assurance, suitable for general trends. In practice all deterioration model outputs are validated against other complimentary measures of business risk.

Table 4: Totex & WLC comparison WTW capital maintenance programme options⁵

Option No.	Description	AMP7 Totex (£m)	Full Whole Life Cost (20 years) NPV (£m).	Willingness to pay support	Ofwat Priority	Other regulator priority	Customer priority	Business strategic alignment	Is this option recommended?
1	Unconstrained expenditure to maintain stable service	£631	£1,988	●	●	●	●	●	No – Offers stable service but increases customer bills in the short-term in excess of their willingness to pay for wastewater services
2	Cost constrained in AMP7. Return to stable in AMP8	£529	£1,960	●	●	●	●	●	Yes – Offers bill reductions with a greater risk of reduced performance in AMP7. Increased risk will be managed through AMP7 strategies
3	Cost constrained in AMP7. Return to stable in AMP8. Reduced mitigation of known high risks in AMP7	£499	£2,008	●	●	●	●	●	No – Offers immediate short-term reduction in bills for an unacceptable corresponding deterioration in performance in AMP7
4	Cost constrained in AMP7. Return to stable in AMP10	£529	£2,255	●	●	●	●	●	No – Offers a sustained reduction in bills until AMP10 for an unacceptable corresponding deterioration in performance until AMP10

Option 1 was discounted due to being cost prohibitive. Options 3 and 4, whilst offering respective reductions in totex outlay, result in a deterioration in performance that is unacceptable to customers, stakeholders, and regulators, and raises the risk profile of the asset base. Option 2 presents a level of investment that offers a high level of value to customers whilst accepting a level of risk that is manageable through resilience strategies discussed above, and is most representative of the option proposed by this business case.

To demonstrate this, Figure 10 summarises the variation in performance for each option, modelled against the customer performance commitment for WTW permit compliance as assessed by the deterioration model.

⁵ For consistency purposes all NPV whole life cost figures are shown in 2017/18 prices (RPI adjusted) and cover a 20 year whole life cost period. Southern Water whole life cost modelling considers that the lower the NPV the more cost beneficial the programme/scheme.

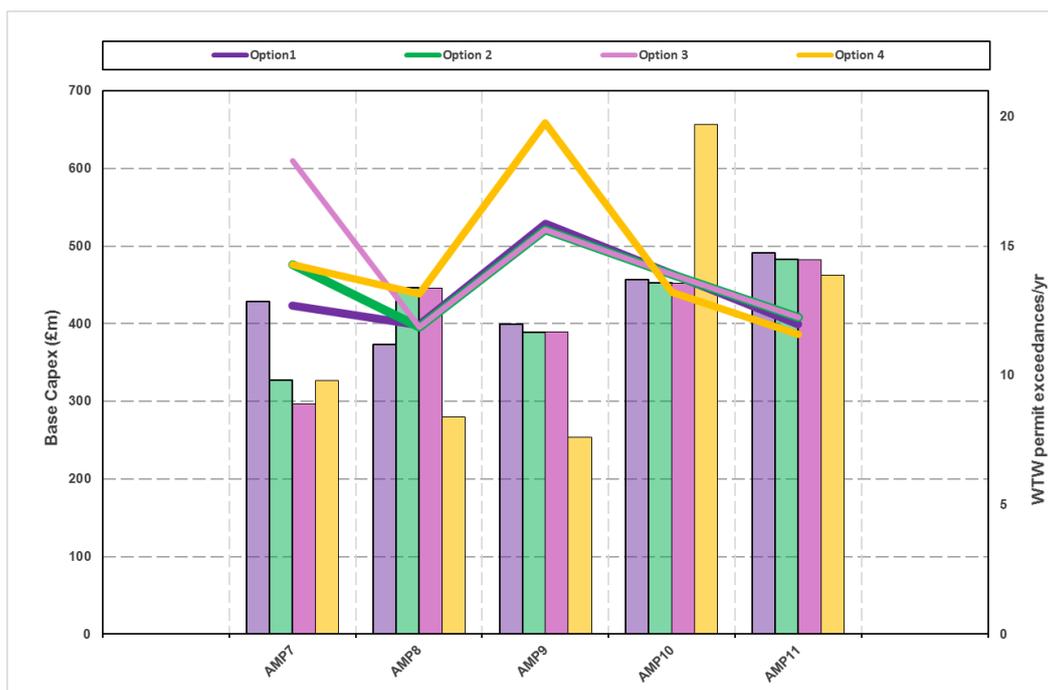


Figure 10: Comparison of the impact of WTW capital maintenance programme options on WTW numeric permit compliance (AMP7 – 11)⁶

Option 1 offers the most stable service and resilience for the greatest total capital outlay.

Option 2 results in a reduction in performance compared to option 1 with a return to stable serviceability in AMP8. Despite this, option 2 maintains favourable performance against the WTW compliance customer measure in AMP7 whilst offering better value for money for customers than option 1.

Option 3 offers an additional £30 million capex saving in AMP7 compared to option 2 in exchange for an unacceptable deterioration in performance in AMP7 and does not represent the strong customer and stakeholder aversion to accepting reduced performance in exchange for lower bills.

Option 4 results in a further deterioration in performance at a yet lower cost, with a return to stable serviceability in AMP10. This offers the lowest cost for customers in the short to medium term but presents an unacceptable risk of environmental degradation. This scenario fails to adequately reflect customer priorities and is therefore for reference only.

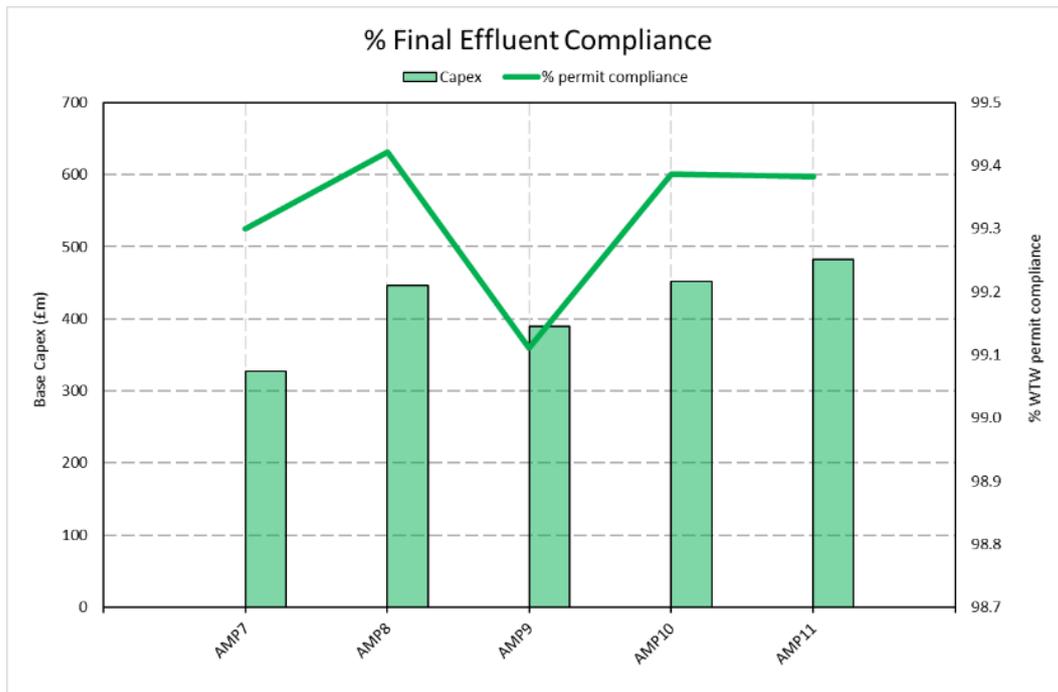
As a result of the optioneering process described, option 2 is the preferred option. It has been promoted due to favourable outcomes for customers and stakeholders and is the central assumption of this business case. The totex position presented offers a ~8% reduction in investment in WTW capital maintenance between AMP6 and AMP7 which further emphasises the need to efficiently operate the existing asset base according to the resilience approaches described in 5.1 above.

The specific performance that option 2 delivers against the established wastewater customer performance commitments in AMP7 and beyond is shown in Figures 11 and 12 below.

In AMP7 we intend to achieve and maintain 99.09% treatment works compliance by 2023. Figure 11 demonstrates the impact of the planned level of investment in AMP7 on the customer performance measure, and projects the future expenditure required to maintain levels of resilience, forecast to AMP11.

⁶ Note: bars show costs mapped to the left vertical axis, lines show performance mapped to the right vertical axis.

Figure 11: Impact of proposed AMP7 investment in Wastewater Treatment base capital maintenance on WTW numeric permit compliance



By constraining capital investment to the proposed AMP7 level we are able to maintain stable treatment works numeric compliance. Due to having extended the useful life of assets that otherwise would have reached end-of-life, maintaining a comparable level of performance beyond AMP7 would require an increase in the level of funding from AMP8 onwards, as an increasing proportion of existing assets deteriorate past their expected useful working lives. We will continue to develop our strategies to mitigate this risk. This approach promotes affordability for customers in the short-term but also presents a corresponding challenge to long term resilience.

In AMP7 we will reduce the amount of pollution events arising from the wastewater treatment asset base and contribute towards a drive to upper quartile performance against the customer performance commitment for category 1, 2, & 3 pollutions.

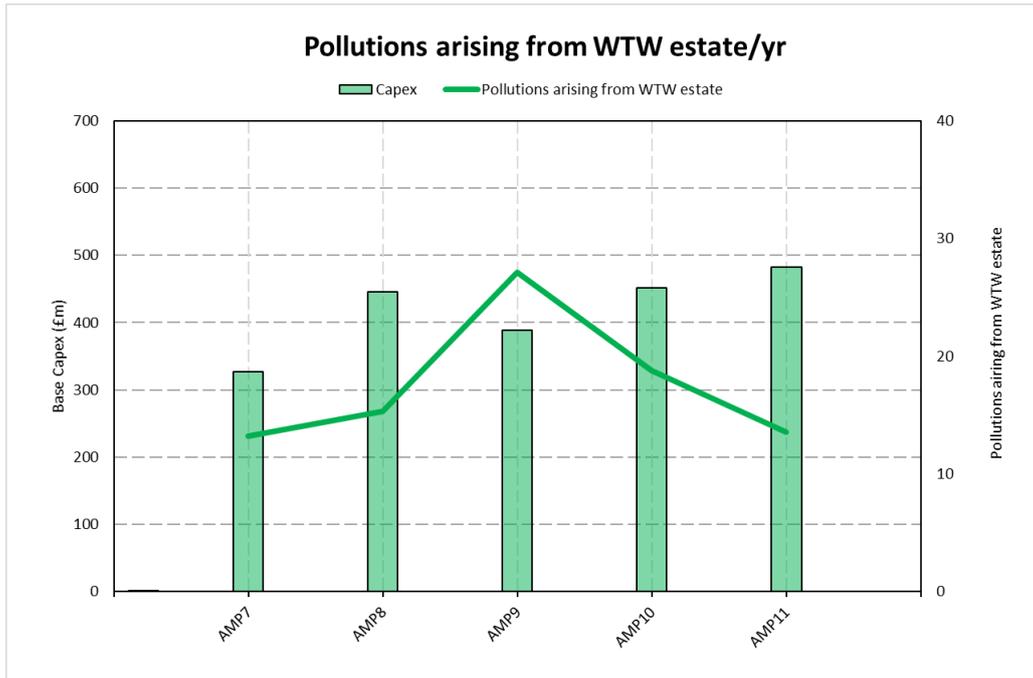


Figure 12: Impact of proposed AMP7 investment in Wastewater Treatment base capital maintenance on category 1, 2, & 3 pollutions arising from the wastewater treatment estate

Figure 12 indicates that constrained capital investment in AMP7 will result in 13 pollution events per annum from the wastewater treatment asset base. Our target is to generate no more than 8 pollutions per year from WTWs by 2024 to contribute to overall upper quartile industry performance by the end of AMP7, enabled by enhanced resilience strategies.

Scheme level

As highlighted in section 5.1 above, the wastewater treatment plan provides for £167 million investment against named risks. The schemes, representing mitigations to specific promoted high capital maintenance risks, were assessed using the mechanisms described previously in section 5.1 and depicted in Figure 9.

As part of our needs assessment process we have costed iterative notional solutions to significant risks. The first option considered is always the 'do nothing' option. If that is eliminated, subsequent solutions are tabled at regular technical reviews and, if required by committee, are rejected in favour of revisions or alternative options. In total 17 interventions have been promoted as named capital maintenance risks. Of these, Table 5 below shows the options generated for schemes of greater than £10 million totex and indicates the reason for selection, including an assessment based on whole life cost analysis (20 year NPV) where relevant.

Table 5: Capital maintenance named risk options⁷

Driver	Scheme	Iteration	Description	Totex £k	WLC £k 20yr NPV	Selected	Reason selected/rejected
Capital maintenance known high risks	[Redacted]	1	External joint repairs	400	-		Short to medium term solution
		2	External drainage	671	-		Does not address root cause
		3	Internal joint repairs entire bed	10,911	6,438	Y	Avoids costly asset replacement
		4	New plastic filters	16,785	-		Cost prohibitive
		5	New ASP	14,853	-		Cost prohibitive
	[Redacted]	1	10no. PST option	17,382	14,482		Cost prohibitive
		2	Actiflow	20,629	21,843		Cost prohibitive
	[Redacted]	3	Refurb spirals + 3no. PST	8,531	6,428	Y	Technically feasible. Lowest WLC
	[Redacted]	1	Total refurb + lift inlet works	47,201	41,567		Cost prohibitive
		2	Inlet solution let to AMP9	15,734	-	Y	Technically feasibility. Risk profiled across multiple AMPs
	[Redacted]	1	Conventional ASP solution	28,407	25,973		To be delivered under quality driver
	[Redacted]	1	Conventional ASP + reed bed refurb	14,800	12,519	Y	Technically feasible. Lowest WLC
	[Redacted]	2	Nutrem ASP	22,936	23,637		Cost prohibitive
	[Redacted]	3	Nereda ASP	17,919	15,607		Cost prohibitive

This process has been applied to all AMP7 costed notional solutions. In wastewater as a whole this process has generated a total of 462 options of which 193 have been included in the investment plan. In addition, each individual WTW receiving investment in AMP7 has had a separate synergy review conducted, which has been effective in ensuring that specific items of scope that impact more than one investment driver have only been costed once, and provides greater assurance of the efficiency of AMP7 proposals, which ultimately promotes long-term affordability for customers.

⁷ Totex and WLC values stated in Table 5 are pre-efficiency, and pre- any adjustments for overheads and CPIH. Table 5 has been included solely to demonstrate the development and selection of scheme level options. Figures stated in Table 5 should be considered to be representative of and not necessarily equivalent to final plan figures as presented in section 5.1 and separately in Appendix 1.

[Redacted] options 1, 2, 4, and 5 were generated as part of business-as-usual activities in AMP6. Figures have been adjusted to an AMP7 price base for comparative purposes.

[Redacted] was originally assessed under a capital maintenance driver. Upon review the solution was judged to have significant scope synergy with a phosphorus improvement driver defined by the WINEP and therefore the iterative optioneering process has been considered and progressed in the separate technical annex [TA.12.WW06 Wastewater Environmental Programme](#). Accordingly a proportionate allocation of the promoted solution has been returned to base via the QBEG mechanism.

5.3. Innovation

In AMP7 we will introduce innovation processes to support the resilient maintenance and planning activities described above.

Asset Performance Function

For AMP7 we have consolidated our wastewater operational service and support functions within the new Asset Performance team. Asset Performance comprises Scientific Support, Process Optimisation, Network Performance and Analytics, Industrial Waste Services, and Maintenance Performance teams.

The function will work to support, challenge, and improve the Wastewater Collection, Treatment, and Maintenance teams in delivering our customer, resilience, and affordability targets by investigating and creating plans and strategies to resolve issues and create opportunities. This focussed activity, successfully trialled in AMP6, will create a framework upon which to build sustained and holistic business improvement initiatives and innovation.

Optimisation Spend-to-Save workstream

We created the Optimisation Spend-to-Save workstream in AMP6 to identify and promote investment opportunities with opex efficiencies as their core driver, targeting initiatives with a short payback window (1 – 3 years).

Initiatives delivered through the Spend-to-Save mechanism include:

- self-cleaning dissolved oxygen probes for use in activated sludge plants;
- non-mechanical sludge thickening solutions for rural WTWs;
- providing additional Commercial Tankered Waste reception capacity;
- collaborating with local manufacturers and engineering firms on innovative trials to utilise high-carbon industrial by-products as a nitrifying agent in wastewater treatment processes; and,
- cake storage capacity to reduce the requirement for stockpiling/double-handling recycled biosolid material before disposal to agricultural land.

We are spending £12 million on Spend-to-Save projects in AMP6, with an associated opex benefit of £4 million/year by year 5. This approach underlines the AMP7 approach to efficiency and innovation.

Research and Development

Good Research and Development practices enable us to develop effective and future-proof technologies whilst utilising local skills and expertise. As part of our wider R&D programme, described in detail in [TA.12.MG04 - Research and Development](#) we established an Innovation Centre at our Petersfield WTW in collaboration with the University of Portsmouth in AMP6.

Case
study



Phosphorus trials¹⁰

Case study

Southern Water are participants in the UKWIR national phosphorus trials for innovation technologies with the task of investigating the Soneco process (combined electro-coagulation and power ultrasound) for phosphorus removal at WTWs. The highly promising results obtained from two successful AMP6 trials and the insights gained have raised the confidence in alternative cost-effective solutions for phosphorus removal at small to medium sized WTWs. The additional confidence is helping to challenge existing internal design standards and will be incorporated into future capital maintenance solutions.



Figure 13: Promotional material for the Petersfield WTW Innovation Hub

Opportunities to incorporate emerging phosphorus removal technologies are contingent upon successful trials. The AMP7 design process is flexible enough to incorporate alternative preferred solutions to reflect best whole life cost as technologies are validated through business as usual R&D activities and suitability testing

Operational Excellence

At its heart Operational Excellence is about making sure we do the basics brilliantly.

It is a holistic strategy across the Wholesale Waste and Water operational, maintenance, and support functions. It aims to rationalise workflows and establish consistent and visible methods of meeting and managing performance and risk across separate operational areas. This replaces centralised management of multiple regional workgroups, which can result in team objectives that are not fully aligned. Operational Excellence addresses this misalignment through stronger collaboration with operational stakeholders and establishing geographical *Hubs* where frontline operational staff can engage with business-level risks and develop innovative solutions to emerging issues. *Hubs* also reinforce a broad catchment-approach to operational and maintenance activities.

¹⁰ http://wwtonline.co.uk/features/eco-friendly-phosphorus-removal-soneco-boom#.WuNCETiV_IU

Operational Excellence will improve resilience in our asset base through direct engagement with frontline staff, exploiting local knowledge and improving the quality and frequency of maintenance tasks. We have trialled Operational Excellence in two catchments so far in AMP6, resulting in productivity improvements, reductions in M&E backlogs, and an increased proportion of planned work completed to time. Operational Excellence will be rolled out to a greater number of functional teams and units in AMP7



Figure 14: An Operational Excellence Hub in action at Ford WTW (June 2018)

You can read more about Operational Excellence in Chapter 7 - Delivering Beyond Resilience in the Round .

5.4. Customer Benefits & Resilience

In this section we present our proposed AMP7 performance commitments and commit to a level of performance against each.

Treatment Works compliance¹¹

In AMP6 our compliance with wastewater performance standards was measured against two customer performance commitments: WTW numeric compliance and WTW population equivalent compliance (as discussed in 3.2 above). The benefit of including both commitments is that the size of the treatment works is taken into account, acknowledging that the failure of a larger WTW is likely to have a greater environmental impact than a smaller one. This approach had a sound basis but has become problematic to enforce in practice as different types of WTW/discharge failures affect performance against either commitment in different ways.

¹¹ Please note a change in the name of this performance commitment between AMP6 and AMP7. In the AMP6 final determination we referred specifically to WTW numeric compliance. The corresponding commitment in AMP7 refers to Treatment Works numeric compliance. As required by the EA's Environmental Performance Assessment methodology, 19 effluent discharges from Water Supply Works (WSWs) were incorporated into the reporting framework during AMP6. Discharges from WSWs are not discussed in this technical annex but do contribute towards performance against this target.

For AMP7 we are proposing to rationalise the way we measure our performance of wastewater compliance by combining the two AMP6 performance commitments into a single measure, one that reflects both the total number and relative size of failed treatment works. The principles behind this proposal are:

- We would align the definition of a failed works, basing it on the more comprehensive set of measures used for numeric compliance. This is far more transparent for our stakeholders and simpler to communicate; effectively a ‘fail is a fail’.
- We would align the penalty threshold with the Environment Agency’s definition of a 4 star works, as used in their annual Environmental Performance Assessment. This demonstrates our commitment to improve performance and aligns our measures of success.
- Any penalties would take account of the number of customers affected by a failed works, with a simple cost per customer served.

There would be a single measure for the performance commitment based on the number of failed works but two parts to any penalty payment. Accordingly, any treatment works that falls into the penalty zone in AMP7 may attract two separate outcome delivery incentive penalties, the first based on the cumulative number of failed works in a year and the second on the population equivalent served by the largest failed works in the same year.

We propose a penalty only outcome delivery incentive mechanism, the deadband for which becomes increasingly challenging as AMP7 progresses. We propose that the penalty criteria are triggered at 6 Treatment Works failures in 2020/21 to a maximum of 10, incurring the full numeric compliance penalty. The deadband decreases to a minimum of 3 treatment works failures by 2023/24 to a maximum of 7, incurring the full penalty. The progressive penalty threshold reflects our enhanced abilities to maintain the level of underlying resilience in the asset base, enabled by AMP7 strategies.

Treatment works falling into the penalty zone will also be subject to a separate outcome delivery penalty based on the number of customers they serve.

Figure 15 below presents the level of performance we commit to achieving against the treatment works compliance customer measure in AMP7. As defined by the EPA methodology, in AMP7 we will have 328 permitted discharges that contribute towards performance against this target, 309 on WTWs and 19 on WSWs.

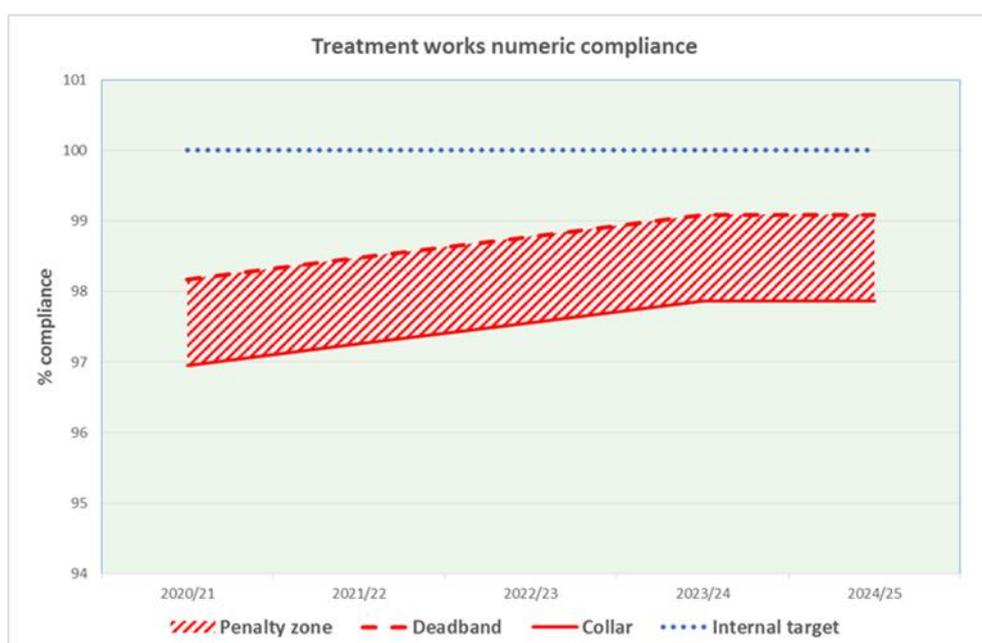


Figure 15: Treatment works numeric compliance. AMP7 projected

Our performance commitment is to aim for 100% compliance at our treatment works. Our forecast performance is 99.09% which is equal to 3 Treatment Works in breach of their environmental permits per year of AMP7. This meets the Environment Agency’s assessment criteria of a 4 star company.

This proposal radically simplifies the way we understand and ensure treatment works compliance and will allow us to deliver better outcomes for our environment and for our customers.

Pollution incidents

Between 2013 - 2018 pollutions from WTWs contributed approximately 10% of total pollution incidents. Investment in wastewater treatment in AMP7 will result in no more than 8 pollution events per year from WTWs by 2024. This commitment aligns to our broader objective to achieve upper quartile performance on pollution incidents during AMP7. By limiting pollutions from WTWs to 8 per year we will be on track to achieve the outcome by 2024, as shown in Figure 16

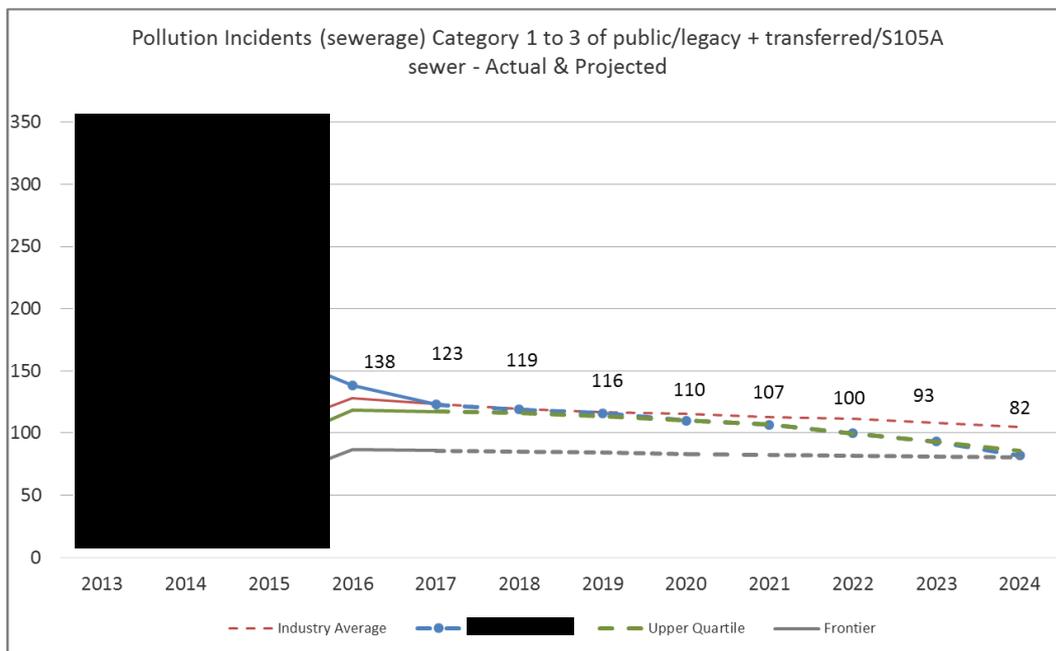


Figure 16: Category 1 -3 pollution incidents (sewerage) – Actual and projected

Figure 16 shows that the planned activities will reduce pollution incidents to close to quartile 1 performance in AMP7.

A full discussion of our pollution strategy can be found in [TA.12.WW07 - Flooding and Pollution Strategies](#).

5.5. Value for Customers

The customer performance commitments that are impacted by investment in wastewater treatment base maintenance (being Treatment works numeric compliance, and Pollution incidents, discussed in the preceding section 5.4), are consistently shown to be medium priorities for customer across all groups, and high priorities for stakeholders.

Customers are highly averse to accepting reductions in the levels of service provided against these measures in exchange for lower bills, and in general are willing to pay for improvements in service levels, through an increase in their annual wastewater bills.

The customer and stakeholder engagement programme and associated insight gathering activities have shown that our customers would be willing to pay:



- **£708,481** per year above what they already pay for water and wastewater services for each reduction of 1 in the number of **Pollution incidents**
- **£939,704** per year above what they already pay for each **Bathing water site improved from less than Excellent to Excellent**
- **£3,549,387** per year above what they already pay for each **Bathing water site improved from less than Good to Good or better**
- **£91,273** per year above what they already pay **for every 1km of river improved to Good status**

Table 6: Insight gathered on customer willingness to pay for wastewater service improvements

Service Attribute	Unit	WTP [£/Unit/Year]		
		Central	Low	High
POLLUTION INCIDENTS	Incident	£708,481	£539,656	£877,305
BATHING WATER at beaches or lakes improved to Excellent	Bathing water site	£939,704	£723,129	£1,156,278
BATHING WATER at beaches or lakes improved to Good or better	Bathing water site	£3,549,387	£2,729,575	£4,369,197
RIVER WATER QUALITY in the Southern Water region	Km river	£91,273	£69,913	£112,634

Despite the clear willingness of our customer to pay for improvements in performance against wastewater measures, we have developed an AMP7 plan to meet their higher environmental expectations at a lower proposed totex level than AMP6. We intend to deliver both a better environment and lower bills.

6. Costing Strategy

Overall costing for AMP7 investment in wastewater treatment base maintenance has been triangulated using top-down modelling for assets approaching the end of their useful lives, bottom-up estimates for schemes to resolve known high risks, and historic expenditure.



Figure 17: Costing strategy triangulation approach

Site specific asset risks and have been prioritised through the business-as-usual, bottom-up planning process (as defined by the Asset Lifecycle Process, described in 5.1). Solutions have been designed to a notional level by our in-house engineering team. The solutions and costs were scrutinised by a panel comprising representatives and subject matter experts from Commercial, Engineering, Operational, and Asset Management teams. The panel approved or rejected solutions and costs based on minuted consensus. Any required alternative options or revised solutions were rejected, minuted, and then re-submitted for approval.

As a result of this process 17 specific named schemes have been selected to target the main wastewater risks, listed in detail in Appendix 1 below.

Regional asset intervention programmes have been modelled using Pioneer. This has identified the overall investment required to maintain stable serviceability at an equipment set level. These interventions will be covered by a series of regional asset class sub-programmes, initially populated and costed by the model, but to be refreshed as part of business-as-usual asset management processes in-AMP using bottom-up views informed via established workstreams and touchpoints.

In all cases, an 11% programme efficiency was applied to selected options.

A full discussion of the costing strategy deployed to generate the AMP7 investment programme can be found in [TA.14.4 - Bottom-up Cost Estimation](#) and [TA.14.5 - PR19 Approach to Optioneering](#).

7. Key Risks and Opportunities

The key risks and opportunities in AMP7 relevant to this technical annex are highlighted below.

7.1. Risks

- There is a risk that during AMP7 the base allocation from our waste water enhancement programmes becomes much larger than has been assumed. This could occur because the work delivered by our environmental or growth programmes in AMP7 is different or larger than that anticipated. This would leave us with less funding available for urgent capital maintenance work and would cause us to overspend our allowances.
- There is a risk in AMP7 that our plant, equipment and telemetry deteriorate at a faster rate than we have assumed. This would lead to higher levels of reactive and planned investment and would require us to overspend our allowances in order to maintain resilience.
- There is a risk that long-term climate change effects will be experienced in our region sooner than much of the UK. The South East will become a stress test for conventional design and working standards for the water industry. Increasingly extreme weather events may delay planned programmes and/or have other unforeseen impacts on established treatment and hydraulic processes. This may require us to significantly increase spend in AMP7. Although this approach would meet acute short-term business drivers it would require us to overspend our AMP7 allowances in order to maintain resilience.

7.2. Opportunities

- There is an opportunity that the base allocation from our enhancement programmes is less than has been assumed. This could occur because the types or volumes of work actually completed in our environmental and growth programs in AMP7 is different from that assumed. This would enable us to advance investment elsewhere to further increase resilience.
- There is an opportunity that holistic catchment management and flow elimination schemes promoted under our Sustainable Drainage 2030 strategy may prove more successful than we have assumed and therefore lead to better outcomes for our customers and our environment.

Appendix 1: List of named schemes

Table 7: List of named schemes

Scheme Name	AMP7 Capex Total	Total AMP7 Opex AFC	AMP7 Totex	AMP8 Capex
	4.389	0.255	4.644	0
	9.987	0	9.987	0
	5.947	0.017	5.964	0
	7.790	0.007	7.797	0
	5.251	0.021	5.272	0
	3.543	0.025	3.567	0
	13.391	0.057	13.448	0
	0.585	0	0.585	0
	5.997	0.061	6.058	0
	13.730	0.099	13.829	0
	4.147	0.052	4.199	0
	1.139	0.018	1.156	0
	1.633	0	1.633	0
	7.147	0.025	7.172	0
	8.716	0	8.716	0
	1.678	0.090	1.768	0
	2.905	0.066	2.971	0
Allocation from Non Infra Growth to Base WTW	33.169	0	33.169	0
Allocation from Quality to Base	42.260	0	42.260	0
Allocation from Base to Growth	-6.428	0	-6.428	0
	166.976	0.793	167.767	0